

1 What is claimed is:

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3 1. A method for communicating a data stream, the method

4 comprising the steps of,

5 generating a sequence of data symbols from the data stream,

6 precoding the sequence of data symbols into a sequence of

7 precoded data symbols,

8 modulating the sequence of precoded data symbols into a

9 continuous phase modulated signal,

10 transmitting the continuous phase modulated signal,

11 receiving the continuous phase modulated signal,

12 demodulating the continuous phase modulated signal into a

13 received baseband signal, and

14 filtering the received baseband signal into a sequence of

15 filtered signals having absolute phase for indicating the sequence

16 of data symbols.

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19 2. The method of claim 1 further comprising the steps of ,

20 sampling the sequence of filtered signals into a sequence of

21 sampled signals, and

22 decoding the sequence of sampled signals into an estimated

23 data stream.

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1 3. The method of claim 1 wherein,
2 the generating step comprises the steps of receiving the data
3 stream of data bits, formatting the data stream into the sequence
4 of formatted data pulses as a sequence data symbols within an M-ary
5 symbol set,
6 the modulating step comprises the steps of Gaussian filtering
7 and frequency modulating for generating the continuous phase
8 modulated signal, the Gaussian filter step filters the precoded
9 sequence of data symbols into pulse responses continuously
10 accumulated over a finite memory time as a filter response, the
11 Gaussian filtering step is defined by a bandwidth time product
12 inversely defining the finite memory time, the frequency modulating
13 step frequency modulates a carrier reference by the filter response
14 by a modulation index for converting the filter response into the
15 continuous phase modulated signal,
16 the demodulating step is carrier demodulating step for
17 demodulating the continuous phase modulated signal using a local
18 carrier into the baseband signal, the carrier demodulating step
19 further removes a carrier phase offset between the local carrier
20 and the received continuous phase modulated signal, and
21 the filtering step is a matched filtering step for matched
22 filtering of the received baseband signal into the filtered signal,
23 the matched filtering is matched by pulse amplitude modulation
24 representation to the Gaussian filtering step, the filtered signal
25 has an absolute phase at a periodic sampling time for indicating
26 the sequence of data symbols.

1 The method of claim 3 wherein the modulating step,
2 the modulation index is equal to a fraction selected from a
3 group consisting of $1/M$ and $1-1/M$ for the M-ary symbol set.

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5 5. A method for communicating data stream, the method comprising
6 the steps of,

7 generating a sequence data symbols from the data stream by
8 formatting the data stream into the sequence of formatted data
9 pulses as a sequence data symbols within an 2-ary symbol set,

10 precoding the sequence of data symbols into a sequence of
11 precoded data symbols,

12 Gaussian filtering the precoded sequence of data symbols into
13 pulse responses continuously accumulated over a finite memory time
14 as a filter response, the Gaussian filtering is defined by a
15 bandwidth time product inversely defining the finite memory time,

16 frequency modulating a carrier reference by the filter
17 response by a modulation index for converting the filter response
18 into the continuous phase modulated signal,

19 demodulating the continuous phase modulated signal by a local
20 carrier and by a carrier phase offset into a received baseband
21 signal, and

22 matched filtering the received baseband signal into a filtered
23 signal, the matched filtering is matched by pulse amplitude
24 modulation representation to the Gaussian filtering, the filtered
25 signal has an absolute phase at a periodic sampling time for
26 indicating the sequence of symbols.

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1 6. The method of claim 5, wherein,

2 the sequence of data symbols has a data symbol d_n at a current
3 symbol time n and has a data symbol d_{n-1} at an immediate previous
4 symbol time n-1 for precoding the data sequence into the sequence
5 precoded data symbols having a precoded data symbol α_n at the
6 current symbol time, the precoding step is defined by $\alpha_n = [d_n -$
7 $d_{n-1} + 1]_{\text{mod}4}$.

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9 7. The method of claim 5, wherein,

10 the sequence of data symbols has a data symbol d_n at a current
11 symbol time n and has a data symbol d_{n-1} at an immediate previous
12 symbol time n-1 for precoding the data sequence into the sequence
13 of precoded data symbols having a precoded data symbol α_n at the
14 current symbol time for even symbol times and for odd symbol times,
15 the precoding step is defined by $\alpha_n = [d_n - d_{n-1} + 1]_{\text{mod}4}$ for even
16 symbol times and $\alpha_n = -[d_n - d_{n-1} + 1]_{\text{mod}4}$ for odd symbol times.

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18 8. The method of claim 5 wherein the modulation index is 1/2.

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20 9. The method of claim 5 wherein the bandwidth time product is
21 1/3.

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23 10. The method of claim 5 wherein the filtering step is a matched
24 filtering step for applying a principal Laurent function to the
25 baseband signal so that the filtered signal comprises a principal
26 Laurent component.

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1 11. A method for communicating data stream, the method comprising
2 the steps of,

3 generating a sequence data symbols from the data stream by
4 formatting the data stream into the sequence of formatted data
5 pulses as a sequence data symbols within an 4-ary symbol set,

6 precoding the sequence of data symbols into a sequence of
7 precoded data symbols,

8 Gaussian filtering the precoded sequence of data symbols into
9 pulse responses continuously accumulated over a finite memory time
10 as a filter response, the Gaussian filtering is defined by a
11 bandwidth time product inversely defining the finite memory time,

12 frequency modulating a carrier reference by the filter
13 response by a modulation index for converting the filter response
14 into the continuous phase modulated signal,

15 demodulating the continuous phase modulated signal by a local
16 carrier and by a carrier phase offset into a received baseband
17 signal, and

18 matched filtering the received baseband signal into a filtered
19 signal, the matched filtering is matched by pulse amplitude
20 modulation representation to the Gaussian filtering, the filtered
21 signal has an absolute phase at a periodic sampling time for
22 indicating the sequence of symbols.

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24 12. The method of claim 11, wherein,

25 the sequence of data symbols has a data symbol d_n at a current
26 symbol time n and has a data symbol d_{n-1} at an immediate previous
27 symbol time n-1 for precoding the data sequence into the sequence
28 precoded data symbols having a precoded data symbol α_n at the

22 Cont.

1 current symbol time, the precoding step is defined by $\alpha_n = [d_n -$
2 $d_{n-1} + 1]_{mod8}$.

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4 13. The method of claim 12 wherein the precoded data symbol α_n is
5 defined by the 4-ary symbol set of +1, -1, +3 and -3.

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7 14. The method of claim 12 wherein the modulation index is 1/4.

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9 (10) 15.3 The method of claim 11, wherein,
10 the sequence of data symbols has a data symbol d_n at a current
11 symbol time n and has a data symbol d_{n-1} at an immediate previous
12 symbol time $n-1$ for precoding the data sequence into the sequence
13 precoded data symbols having a precoded data symbol α_n at the
14 current symbol time, the precoding step is defined by $\alpha_n = [d_n -$
15 $d_{n-1} + 3]_{mod8}$.

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17 16. The method of claim 15 wherein the precoded data symbol α_n is
18 defined by the 4-ary symbol set of +1, -1, +3 and -3.

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20 17. The method of claim 15 wherein the modulation index is 1/4.

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22 (18) 18. The method of claim 11 wherein 10 wherein the filtering step
23 is a matched filtering step for applying a principal Laurent
24 function, a third Laurent function and a twelfth Laurent function
25 to the baseband signal so that the filtered signal comprises a
26 principal Laurent component, a third Laurent component and a
27 twelfth Laurent component.

1 19. The method of claim 11 wherein the modulation index is 3/4.

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3 20. The method of claim 11 wherein the bandwidth time product is

4 1/3.

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